A MONOGRAPH OF THE AUSTRALIAN LORICATES.

(Phylum Mollusca—Order Loricata).

By Tom Iredale and A. F. Basset Hull.

II. Family Ischnochitonidae.

The Family Ischnochitonidae embraces nine genera, about thirty-seven species, with some seven subspecies and a few of doubtful status. The members of this family are generally found below median tide mark down to depths of twenty-five fathoms, but mainly within one fathom below that mark. With the exception of one genus—*Stenochiton,* which inhabits the roots and blades of sea-grasses—all species are found on the under sides or at the edges of insertion in the sand of movable stones, or on the rock surface under such stones. The animals are the most alert and active of the whole Order, some species dropping off the stones when they are raised to the surface, while others move rapidly on the stones to gain the under side and escape the light. They are largely mobile, moving up or down the littoral zones with the decrease or increase in the surface temperature of the water. They are also very sensitive to the encroachment of sand in the pools they inhabit, moving out as the loose stones become covered with the sand, and returning when the changing currents have removed the sand.

No satisfactory grouping of the genera can be achieved from the study of the external characters alone. It is true that the sculpture falls into three easily recognisable variations—bold, moderate, and weak—and the girdle scales may be separated into dull and polished, striated, deeply grooved and smooth, uniform and irregular in size, but the sculpture and scale characters do not fall into any natural arrangement such as is possible when the median valves are separated and the slitting examined. This provides a differential character which, used with those of sculpture and scales, furnishes all the requirements of a satisfactory key to the genera.

The differential characters of the genera may be epitomised as follows:—

Insertion plates of median valves with one slit.
- Girdle-scales oval, moderately convex, not highly polished, horizontally grooved.
  - Scales large or medium .. .. *Ischnochiton.*
  - Scales very small .. .. *Autochiton.**
  - Scales of varying sizes.
    - Not deeply grooved .. .. *Heterozona.*
    - Deeply grooved .. .. *Strigichiton.*
- Girdle-scales rounded, highly polished .. .. *Haploplax.*

Insertion plates of median valves with more than one slit.
- Girdle-scales small, flat, lozenge-shaped, smooth and highly polished.
  .. .. *Stenochiton.*
- Girdle-scales highly convex, horizontally striate
  - Scales small, regularly oval .. .. *Anisoradsia.*
  - Scales large, rounded, uniform in shape .. .. *Ischnoradsia.*

Insertion plates of median valves unslit .. .. *Subterenochiton.*†

**Autochiton* gen. nov. Type: *Ischnochiton torri* Iredale and May.

†*Subterenochiton* gen. nov. Type: *Ischnochiton gabrieli* Hull.

Genus Ischnochiton.

Ischnochiton Gray, P.Z.S., 1847, 126. Type by subsequent designation (id., ib., 168), *Chiton textilis* Gray.

Shells of medium size for the family, of varied colouration, elongate ovals, sculpture of pustules in quincunx pattern, sometimes confluent into irregular lines, divaricating on end valves and lateral areas of median valves, rarely on central areas; scales on girdle large or small but always more or less striated and oval. Insertion plates sharp, not pectinated or thickened, more than eight slits in end valves, the normal slitting probably being twelve, but always variable from nine to fourteen, slits being most numerous in young examples. Sutural laminae large, separated; only one slit each side in median valves.

While it would be difficult to prepare a Key to the species, the distinctive features can be indicated as follows:—

Girdle scales large:
Sculpture on end valves strong radials .. .. *versicolor.*
Girdle scales smaller:
Sculpture on end valves moderate radials:
Median areas with very strong ridges .. .. *falcatus.*
Median areas with heavy nodulose ribs .. .. *pilsbryi.*
Sculpture on end valves weak radials .. .. *elongatus.*
Lateral area with toothed edge .. .. *tateanus.*
Median areas with zigzag wrinkles .. .. *ptychius.*
Sculpture on end valves strong semi-nodulose radials .. .. .. *variegatus.*
Median areas with zigzag lines .. .. *lineolatus.*
Sculpture on end valves separated pustules .. .. *contractus.*
Girdle scales very small:
Sculpture on end valves weakly radiate .. .. *examinandus.*
Sculpture minutely pustulose throughout .. .. *luticolens.*
Sculpture strongly pustulose throughout .. .. *atkinsoni.*

In pattern the sculpture of the lateral areas of the median valves closely resembles that of the end valves.

Ischnochiton elongatus.

(a) Ischnochiton elongatus elongatus.

Plate xxxiii., figs. 1-1a.

Chiton elongatus Blainville, Dict. Sci. Nat., xxxvi., 1825, 542. New Holland (Peron and Lesueur). (We select Kangaroo Island). Type in Paris Museum.

Chiton ustulatus Reeve, Conch. Icon., iv., 1847, pl. xvii., sp. and f., 102. Australia (Jukes). Type in Brit. Mus. Iredale and May, Proc. Mal. Soc., xii., 1916, 110, pl. xii., f. 3a'. Not *Ischnochiton ustulatus* of Bednall and recent writers.

Ischnochiton crispus var. *decorata* Sykes, Proc. Mal. Soc., ii., 1896, 87. Port Phillip, Victoria (Bracebridge Wilson). Type in Melbourne Museum.

Ischnochiton decoratus Sykes, Iredale and May, Proc. Mal. Soc., xii., 1916, 110, pl. iv., f. 3a'''.

Ischnochiton lineolatus Blainville, Dupuis, Bull. Mus. Paris, 1918, 526. Ashby, Trans. Roy. Soc. S. Aust., xliv., 1920, 272, pl. xi., f. 3 (review). May, Illus. Index Tas. Shells, 1923, pl. xiv., f. 12. Not *Chiton lineolatus* Blainville, 1825.

Shell medium, rather elongately ovate; moderately elevated; sub-carinated; side slopes rounded. Sculpture weak in juvenile, well expressed in adult examples. Colour extremely variable:—(a) Olive-green, thickly painted with dots of a darker colour. (b) With broad dorsal stripe in white, extending from the centre of the anterior valve to behind the mucro of the posterior valve, sometimes relieved by V-shaped markings on valves ii. to vii., with an inverted V. on the posterior valve, the apex of which touches the mucro; the rest of the shell uniformly coloured in black, grey, red, blue, brown or green, or with curved lines in colour tending towards the jugum. (c) Uniformly coloured or stippled in black, dull purple, red, blue, brown or green. (d) Uniformly white, with girdle brown, maculated, or bright yellow. (e) Ground colour white or yellowish, the colour pattern formed by dots on the jugum and curved narrow to broad short lines increasing in width towards the margin, in black, grey, brown, purple or rose. (Sykes's *decoratus*).*

Anterior valve having 40-50 radiating rows of elongated pustules, becoming obsolete on the apex.

Median valves; lateral areas strongly raised, having 8-20 radiating rows of elongated pustules; central areas finely sculptured with lirae curving inwards towards the jugum.

Posterior valve large, the mucro prominent, slightly in front of the middle; ante-mucronal area similar to central areas of median valves, post-mucronal area similar to anterior valve, but the pustules generally larger, more prominent, and less continuous.

Girdle scales medium, uniform, rounded ovals, horizontally deeply grooved, about six to a scale.

Interior white. Slits 11-1-13. Sinus very broad.

Dimensions: Average adult 25 x 13 mm. Maximum 32 x 15 mm.

Station: Under stones between median and lowest spring tide marks; occasionally found in root-sheaths of *Zostera*.

Habitat: Victoria from Wilson's Promontory on the east coast to South Australia, and Tasmania.

Remarks: This is one of the commonest Loricates, being found in practically every sheltered pool or in smooth water inlets and harbours.

Though Dupuis, Ashby and Lamy have recorded that the "types" of *lineolatus* Blainville in the Paris Museum were shells of *crispus* auct., none searched for the "types" of *elongatus*, based on many examples also in that Museum. The description of *elongatus* is clearly applicable to the present species, and the shells described by Blainville probably came from Kangaroo Island, where Peron and Lesueur made a very large collection which was never reported on, and examples from that locality loaned us by Mr. E. H. Matthews agree in detail with the original description.

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* Note.—The descriptions have in all cases been written by us from normal examples, the original author's description being in some cases (as in the early authors) totally inadequate, and in later instances unnecessarily diffuse for the purposes of a work such as this monograph.

The size "small," "medium," or "large" is based upon an arbitrary standard established for each genus. The standard for the genus Ischnochiton is:—Small, under 15 m.m. for average adult; medium, over 15 and under 30 m.m. do.; large, over 30 m.m. do.

(b) Ischnochiton elongatus crispus.

Plate xxxiii., fig. 1b.

Chiton crispus Reeve, Conch. Icon., iv., 1847, pl. xix., sp. and f. 120. Australia = Port Jackson, N.S.W. Type in Brit. Mus.

Chiton mesoleucus Lichtenstein, Verz. Samml. neuholl. Nat., 1837, 9. New South Wales, *nom. nud.*

Chiton longicymba Sowerby, Conch. Illus., 1840, f. 67, and of many other authors until Pilsbry, but not *Chiton longicymba* Blainville, 1825.

Ischnochiton haddoni Pilsbry, Man. Conch., xiv., 1892, 88, pl. xxii., f. 67-73. Port Jackson, N.S.W. Type in Acad. Nat. Sci. Philadelphia.

Ischnochiton crispus Reeve, Pilsbry, Nautilus, viii., 1895, 129. Ashby, Trans. Roy. Soc. S. Aust., xliv., 1920, 272, pl. xi., f. 4.

Shell similar in sculpture and variable colour to the preceding species. Differs only in the girdle scales, which are rather smaller, and the grooving is weaker.

Habitat: Mallacoota Inlet, Victoria, and New South Wales from Twofold Bay to Broughton Island; probably extending much further north, but not reaching Queensland.

Ischnochiton variegatus.

Plate xxxiii., fig. 2.

Lepidopleurus variegatus H. Adams and Angas, P. Z. S., 1864, 192. Yorke's Peninsula, South Australia.

Ischnochiton atkinsoni lincolnensis Ashby, Trans. Roy. Soc., S. Aust., xliv., 1920, 275, pl. xii., f. 5a, 5b. San Remo, Victoria, etc.

Shell medium, elongate oval, moderately elevated, semi-carinated, side slopes convex. Colour distinctive, whitish mottled with brown and black, the mottlings generally forming a continuous dark line down each side, leaving a broad white dorsal stripe, with a few indistinct splashes on the jugum.

Anterior valve rayed with numerous fine low ribs, divaricating anteriorly and becoming semi-nodulose through concentric growth lines cutting them; missing towards the apex.

Median valves with the central areas finely decussated in quincunx, laterally developing irregular fine linear ridges; lateral areas ribbed more boldly than the anterior valve, the nodulose sculpture becoming more notable through the concentric growth lines being more pronounced.

Posterior valve with the mucro ante-median; ante-mucronal area as median central areas; post-mucronal area showing similar sculpture to anterior valve, but much more nodulose.

Girdle scales small, less than those of *I. elongatus crispus* Reeve, elongate ovals, closely packed and finely grooved with six to eight ridges.

Interior white. Slits 12-1-12.

Dimensions: 20 x 10.5 mm.

Station: Between tide marks.

Habitat: South Australia.

Remarks: This species was well described but not figured, and was recognised by Pilsbry, Bednall (who adapted the original description), Matthews and Torr, but Ashby, through an oversight, neglected it and redescribed the species as a form of *I. atkinsoni* Iredale and May, naming it *I. a. lincolnensis*. While showing a little variation it appears to be fairly constant and restricted to South Australia and western Victoria, though the confusion with *I. atkinsoni* has some-

what complicated the records. The type of *I. variegatus* is at present missing, but we figure a neotype, collected for us by Mr. E. H. Matthews, at Minlacowie, Hardwicke Bay, South Australia, the exact locality whence Angas described it.

Ischnochiton examinandus.

(a) Ischnochiton examinandus examinandus.

Plate xxxiii., figs. 3a, b, c, d.

Ischnochiton examinandus Hull, Aust. Zool., iii., 1923, 160, pl. xxv., f. 1-4. Long Reef, near Manly, N.S.W. Type in Australian Museum.

Shell small, a little depressed, semi-carinate, side slopes slightly convex. Colour: the whole shell is covered with a reticulated pattern in dull pink, having darker brownish pink mottlings. Scattered irregularly over the anterior valve, in the central areas and, in some valves, on the jugum are blotches of yellowish maculated with dark greenish; the whole presenting a distinctive marbled scheme of pink and green. (Type). Other examples are wholly pink, pink with black markings on some valves, and yellowish.

Anterior valve superficially almost smooth, but having a quincuncial punctation developing into ribbing only at the edges, the pustules close and flattened.

Median valves with central areas finely quincuncially punctate, lateral areas raised and similarly sculptured, ribbing developing only slightly towards the girdle.

Posterior valve with mucro ante-median; ante-mucronal area as preceding, post-mucronal area similar to anterior valve in sculpture, no ribbing noticeable.

Girdle broad; scales small, closely packed, beautifully regular, and carved with about eight even grooves.

Interior pinkish-white. Slits 10-1-10.

Dimensions: 14 x 8 mm.

Station: Under stones and on dead shells below low water mark; rather solitary; also dredged in 6-8 fathoms.

Habitat: New South Wales (central and southern coast).

Remarks: This shell can be distinguished from *I. elongatus crispus* by its generally broader dimensions, wider girdle, and smaller girdle scales, as well as the absence of distinctive sculpture. Juvenile shells show no radials, and senile ones only a little.

(b) Ischnochiton examinandus laetior.

Plate xxxiii., figs. 3, 3e, f, g, h.

Ischnochiton examinandus laetior Hull, Aust. Zool., iii., 1923, 160, pl. xxiv., f. 14-17. Caloundra, Queensland. Type in Australian Museum.

Shell very like the preceding in detail, but with much more varied colouration, some being typical pink and green marbled examples, while others range from ochraceous to deep pink; some are decorated with a broad white dorsal stripe varying in breadth, disposed somewhat after the manner of the common colour pattern of *I. versicolor* Sowerby.

The sculpture throughout is stronger; the radial ribbing more pronounced on the anterior valve, the lateral areas of the median valves and on the posterior valve.

Dimensions: 15 x 9 mm.

Station: Under and on pebbles and small stones between tide marks; generally in shallower water than the southern species.

Habitat: Caloundra and Point Cartwright, south Queensland.

Ischnochiton lineolatus.

Plate xxxiv., figs. 2, 2a.

Chiton lineolatus Blainville, Dict. Sci. Nat., xxxvi., 1825, 541. Ile King (Peron and Lesueur). Type, Paris Mus.

Chiton contractus Pilshry, Nautilus, viii., 1895, 129, and all subsequent writers to 1916, but not of Reeve.

Ischnochiton lineolatus Iredale and May, Proc. Mal. Soc., xii., 1916, 108, pl. iv., f. 1, 1a. Flinders Group, Bass Strait.

Ischnochiton iredalei Dupuis, Bull. Mus. Nat. Paris, 1918, 526. New name for *contractus* auct. *non* Reeve = Flinders Group. Ashby, Trans. Roy. Soc. S. Aust., xliv., 1920, 272. May. Illus. Index Tas. Shells, 1923, pl. xiv., f. 11.

Chiton pallidus Sykes, Proc. Mal. Soc., ii., 1896, 82, in synonymy. Not *C. pallidus* Reeve, Conch. Icon., iv., 1847, pl. xvi., sp. and f. 92. Loc. unknown, prob. Africa. Type Mus. Cuming in Brit. Mus.

Ischnochiton iredalei kingensis Ashby and Hull, Aust. Zool., iii., 1923, 81, pl. viii., f. 1-4. Fraser Bay, King Island, Bass Strait.

Shell large, elongately oval, the ends rounded, not contracted; semi-carinated, slightly elevated, side slopes straight.

Colour distinctive, white or yellowish with brown or blackish longitudinal splashes down the middle, generally on each side of the jugum, fewer spots towards edges; sometimes the splashes are repeated on the outer margins of the lateral areas.

Anterior valve rayed with very closely packed irregular linear ridges, semi-jugum, coarser and nearly straight towards the girdle: lateral areas irregularly nodulose at edges through cutting by concentric growth lines, but nodules elongate and *not* separated and rounded: lateral edges semi-nodulose.

Median valves with the central areas showing zigzag ridges, fine on the rayed and concentrically cut, the rays consisting of massed pustules irregularly arranged.

Posterior valve with the mucro ante-median, the ante-mucronal area sculptured as median central areas, but sculpture finer; the post-mucronal area showing a sculpture consisting of separated pustules irregular in shape and massing towards margin, where they become confluent but are cut by concentric growth lines.

Girdle scales regular, rather rounded, fairly large, evenly grooved with Interior white. Slits 11—12-1-12—14.

Dimensions: Maximum 50 x 25 mm.

Station: On the underside of stones below median tide mark.

Habitat: Southern Australia, from King George Sound to Western Port, Victoria; Islands of Bass Strait and Tasmania.

Remarks: Iredale and May revived the Blainvillean name *lineolatus* for this species, the description exactly conforming and the locality cited agreeing. Dupuis, from an examination of the specimens in the Paris Museum, concluded that Blainville's "types" of *lineolatus* were not the present species, but were the shell known as *"crispus"* and he therefore renamed this species *iredalei.* Ashby has recently acquiesced in this view as has also Lamy, but none of these viewed the matter judicially. Blainville compared this species with his own *"elongatus"* founded upon *many examples* in the Paris Museum. None of the workers cited attempted to trace in that Institution this species (*elongatus*) which we have recognised as the southern form of *crispus* (ante). Consequently Blainville's *lineolatus* which was contrasted with *elongatus* would easily apply to this present species as Iredale

and May showed. The conclusion is that neither Dupuis, Ashby nor Lamy saw the original shells described by Blainville as *"lineolatus,"* hut saw specimens of *"elongatus"* which had been wrongly labelled. Rochehrune was prohably responsible for this, and his errors are well known. Blainville cited King Island as locality, and in this case this appears to be correct as May and Hull have recently collected this species there, it being very common on the eastern coast. Ashhy and Hull named the King I. form *I. iredalei kingensis*, the variation they regarded as geographical, having been since determined as individual only. When Dupuis proposed *I. iredalei* as a new name for *I. contractus*, he cited no definite locality, so we designate Flinders Island as the type locality, citing the specimen figured by Iredale and May from that locality as typical.

ISCHNOCHITON CONTRACTUS.

Plate xxxiii., fig. 5.

Chiton contractus Reeve, Conch. Icon., iv., 1847, pl. xv., sp. and f., 78. New Zealand (error = South Australia). Type Mus. Cuming in Brit. Mus.

Chiton sulcatus Quoy and Gaimard, Voy. Astrolabe, iii., 1835, 385, pl. 75, f. 31-36. King George Sound, South-west Australia. Type in Paris Mus. Not *Chiton sulcatus* Wood, Gen. Conch., Pt. 1, 1814, 15.

Chiton decussatus Reeve, Conch. Icon., iv., 1847, pl. xviii., sp. and f. 107. Australia (Jukes). Type Mus. Cuming in Brit. Mus.

Chiton castus Reeve, Conch. Icon., iv., 1847, pl. xxii., sp. and f., 145. Loc. unknown. Type in Brit. Mus.

Lepidopleurus speciosus H. Adams and Angas, P.Z.S., 1864, 192. Port Lincoln, South Australia.

Gymnoplax urvillei Rochbrune, Bull. Soc. Philom. Paris, 7th Ser., v., 1881, 121. Based on type specimen of *C. sulcatus* Q. and G.

Ischnochiton intergranosus Carpenter M. S. Pilsbry, Man. Conch., xiv., 1892, 93, in synonymy.

Ischnochiton decussatus Pilshry, Nautilus viii., 1895, 129, and suhsequent writers to 1916.

Ischnochiton contractus Iredale and May, Proc. Mal. Soc., xii., 1916, 107. May, Illus. Index Tas. Shells, 1923, pl. xiv., f. 9.

Shell large, elongate oval, a little contracted at the ends, semicarinated, side slopes straight, moderately elevated.

Colour distinctive, white or yellowish with flame marks of brown or greenish along the dorsal area; girdle dark hrown.

Anterior valve closely covered with small rounded separated pustules, finer towards the apex.

Median valves with central areas sculptured with sloping lincar ridges, ahout thirty on each side of the jugal ridge, which is finely decussately striate, the lines sloping from the jugal area towards the girdle: lateral areas sculptured as anterior valve, the pustules rarely tending to amalgamate towards the edges.

Posterior valve with the mucro ante-median: ante-mucronal area sculptured as median central areas, the post-mucronal area as anterior valve.

Girdle scales rather large, rounded, regular with ahout six to eight deep even grooves.

Interior white, under jugum dark. Slits, 12-1-12.

Dimensions: 38 x 21 mm.

Station: Under stones helow median tide mark.

Hahitat: Western Australia from Fremantle south and east to South Australia, Victoria, and Furneaux Group, Bass Strait.

Ischnochiton versicolor.

(a) Ischnochiton versicolor versicolor.

Plate xxxiv., fig. 1h.

Chiton versicolor Sowerby, Mag. Nat. Hist. (Charlesworth), iv., 1840, 292. (Conch. Illns. fig. 75; and fig. 122 = var. alb.). Loc. unknown; collected by Dr. Stanger.

Chiton proteus Reeve, Conch. Icon. iv., 1847, pl. xviii., sp. and f. 111. Newcastle, N.S.W. Type Mus. Cuming in Brit. Mus.

Ischnochiton divergens Pilsbry, Man. Conch., xiv., 1892, 90, pl. 22, f. 74-77. Port Jackson, Australia. Not *Chiton divergens* Reeve. (Port Jackson).

Ischnochiton intricatus and *intricandus* id. ib. ex Cpr. M.S. in synonymy.

Ischnochiton proteus Iredale and May, Proc. Mal. Soc. (Lond.), xii., 1916, 109, pl. v., fig. 2a‴

Shell large, elongate oval, head valve small, tail valve large, median valves deep, a little flattened, semi-carinated, side slopes convex.

Colour very variable, the most frequent being sage green, with a lighter dorsal stripe, but uniform white, rose, blue or brown are not uncommon, while the same ground colours are often maculated or splashed with black or brown.

Anterior valve small, rayed closely with numerous ridges, towards the edge intercalating riblets appearing.

Median valves: Central areas sculptured toward the edges with fine wavy linear ridges, finer towards the jugum where they show a fine zigzag character; lateral areas with three or four primary ribs divaricating towards the girdle, the interstices finely punctate.

Posterior valve with mucro ante-median, the ante-mucronal area sculptured as median central area, the post-mucronal area with irregular elongate pustules which amalgamate into ribs and show divarication.

Girdle scales large rounded ovals, evenly placed all over the girdle, very regularly deeply grooved, with six to eight ridges.

Interior pinkish or bluish white, according to external coloration, red horseshoe in tail valve, slits 10-1-10.

Dimensions: 60 x 30 mm. (maximum observed).

Station: Under stones below median tide mark.

Habitat: New South Wales and Mallacoota Inlet, Victoria.

(b) Ischnochiton versicolor milligani.

Plate xxxiv., figs. 1, 1a.

Ischnochiton milligani Iredale and May, Proc. Mal. Soc., xii., 1916, 109, pl. v., f. 2, 2a'. Port Arthur, S. Tas. Type in Tas. Mus. May, Illus. Index Tas. Shells, 1923, pl. xiv., f. 14.

Differs in its generally larger size, more complicated sculpture on lateral areas, and coarser sculpture on central areas of median valves; more numerous ridges on head and tail valves and comparatively smaller scales.

Slitting in young shells 13-1-13, senile 9-1-11.

Habitat: Tasmania, South Australia, Victoria.

Remarks: A very common shell in most localities, and especially notable for its brilliant coloring. A long series collected by Roy Bell at Twofold Bay, N.S.W., Mallacoota and Port Fairy, Victoria has proved that the variation can only be regarded as subspecific, though the extremes are abundantly distinct.

This species was undoubtedly described by Sowerby in 1840 as *Chiton versicolor*, the figures and description being unmistakeable.

ISCHNOCHITON FALCATUS.
Plate xxxiv., figs. 6, 6a, b, c, d.

Ischnochiton falcatus Hull, Proc. Roy. Soc. Vict., xxv., 1912, 121, pl. viii. Western Port, Victoria, dredged 6-8 fath. Type in Coll. Gabriel. May, Illus. Index Tas. Shells, 1923, pl. xiv., f. 10.

Ischnochiton sculptus Gatliff and Gabriel, Proc. Roy. Soc. Vict., xxi., 1908, 383. Not *Chiton sculptus* Sowerby, 1840.

Ischnochiton tateanus Sykes, Proc. Mal. Soc. (Lond.), ii., 1896, 87. Tate and May, Proc. Linn. Soc. N.S.W., 1901, 413.

Shell small, oval, elevated, carinated, side slopes straight.

Colour: Yellowish-brown.

Anterior valve rayed with twenty-five ridges tending to divaricate towards edge of girdle: lateral edges strongly toothed.

Median valves: Central areas punctate on jugum, curved ridges developing laterally with wider interspaces, widely spaced towards girdle: lateral areas elevated with two prominent ribs either divaricating towards girdle, lower rib massive and broken into a dozen separated saw teeth.

Posterior valve with the mucro median: ante-mucronal area sculptured with curved lines as median central area; post-mucronal area simply punctate behind mucro, developing concentric rows of tubercles towards edge.

Girdle scales small regular flattened ovals with about ten shallow ridges.

Interior: Pinkish-white. Slits 11-1-13.

Dimensions: 15 x 9 mm.

Station: Dredged in 6-15 fathoms.

Habitat: Victoria and Tasmania.

ISCHNOCHITON PTYCHIUS.
Plate xxxiv., fig. 5.

II. Family *Ischnochitonidae.*

Ischnochiton ptychius Pilsbry, Nautilus, viii., 1894, 53. Gulf St. Vincent, South Australia. Type in Brit. Mus.

Shell small, elongate oval, semi-carinated, side slopes straight.

Colour distinctive, pinkish mottled with whitish, rarely.

Anterior valve quincuncially punctate, obsoletely rayed.

Median valves: Central areas quincuncially punctate, but with zigzag striae developing at sides. Lateral areas obsoletely three or four ribbed, ribs flattened, suggesting towards edge confluent pustules, lateral edges thickened not toothed.

Posterior valve: Mucro ante-median, ante-mucronal area as median central areas: post-mucronal area obsoletely rayed with seminodulose flattened ribs.

Girdle scales comparatively large, regular flattened ovals, finely grooved with about ten ridges.

Interior: Pinkish-white. Regular Ischnoid slitting.

Dimensions: 11.5 x 7 mm.

Station: Below low water mark.

Habitat: South Australia (Gulf St. Vincent).

Remarks: A rare shell, the above description may be modified a little when series are collected: a magnificent example collected by Mr. E. H. Matthews, 21 x 12 mm., shows the zigzag sculpture of the central areas of the median valves very prominently; and the lateral edge semi-nodulose, but still not toothed.

ISCHNOCHITON TATEANUS.
Plate xxxiv., fig. 4.

Ischnochiton tateanus Bednall, Proc. Mal. Soc., ii., 1897, 147, pl. xii., f. 3 and text-fig. Sultana Bay, Yorke's Peninsula, South Australia. Dredged. Type in coll. Matthews ex Bednall.

Shell small, broad oval, flattened, semi-carinated, sides slopes convex. Colour French grey, flecked with white; uniform rose pink, or yellowish.

Anterior valve rayed with about 35 undulating flat ribs with connecting concentric waved riblets, lateral edge strongly serrated.

Median valves: Central areas rather coarsely quincuncially punctate, the pustules massing into wavy lines towards the girdle; the lateral areas with three to five flat ribs, the outsides regularly toothed so as to show a rounded saw edge.

Posterior valve with the mucro median; ante-mucronal area sculptured as central area; post-mucronal area sculptured as anterior valve, but sculpture less definitely marked.

Girdle scales small regular flattened ovals, evenly grooved, with eight low ridges.

Interior white or pinkish. Slits 12-1-12.

Dimensions: 13 x 9 mm. (grey), 20 x 13 (rose pink).

Station: Dredged on shells in 5-30 fathoms.

Habitat: South Australia, Victoria, Tasmania, and southern New South Wales.

Remarks: The typical form (from South Australia) is characterised by strongly marked sculpture, especially the serrations on the posterior margins of valves i.-vii.

Specimens dredged by Roy Bell in Disaster Bay 12-20 fathoms and Twofold Bay 20 fathoms, in New South Wales are smaller, more elongate, much more elevated, and less marked in sculpture. The rose and yellowish colours predominate in these localities. For the New South Wales shell we propose the subspecific name *I. t. paradisiacus.*

Ischnochiton pilsbryi.

Plate xxxiii., fig. 4.

Ischnochiton pilsbryi Bednall, Proc. Mal. Soc., ii., 1897, 143, pl. xii. Sultana Bay, Yorke's Peninsula, South Australia. Type in coll. Matthews ex Bednall.

Shell medium, regular elongate oval, wide girdle, round back, moderately elevated, the posterior edges of anterior and median valves raised and strongly callused. Colour: uniform yellowish buff.

Anterior valve with apex sinused, a little recurved, posterior edge thickened and raised; sculptured with regular rays of nodules about forty in number at edge, obsolescent at apex where pustules are coarse, but much smaller.

Median valves: Central areas showing irregular ridges of massed pustules rather separated and comparatively few, about fifteen being counted, the jugum showing coarse pustules only; lateral areas showing two to four ribs of separated large tubercles, the interstices between being minutely granulose.

Posterior valve with the mucro low and median, the ante-mucronal area as median central area, post-mucronal area minutely granulose, pustules forming towards girdle and becoming concentrically arranged.

Girdle very broad; scales long ovals comparatively large and flattened, laid down in order, not imbricating; glossy, showing twelve shallow grooves.

Interior white. Slits 11-1-11.

Dimensions: 24.5 x 15 mm. Maximum: 28 x 16.

Station: Under large blocks of limestone at low tide.

Habitat: Yorke's Peninsula, South Australia.

Remarks: The fine series loaned us by Mr. E. H. Matthews enables us to give some details of the growth stages of this rare shell. The youngest one 10 x 6 mm. shows a coarsely pustulose surface, the pustules running into lines at the edges of the median central areas and a few large tubercles appear at the edge of the lateral areas. In the second stage the linear and confluent arrangement on the central areas becomes more pronounced, while tubercles appear round the

edges of the end valves; sometimes the tubercles increase in size without massing, in other cases forming irregular lines before becoming very large.

ISCHNOCHITON ATKINSONI.

Plate xxxiv., figs. 3, 3a, 3b.

Ischnochiton atkinsoni Iredale and May, Proc. Mal. Soc., xii., 1916, 110, pl. iv., f. 3. Sulphur Creek, N.W. Tas. Type in Tas. Mus. May, Illus. Index Tas. Shells, 1923, pl. xiv., f. 8.

Shell small, elongate oval, elevated, roundbacked, not carinated. Colour, uniform buff.

Anterior valve quincuncially punctate, obsoletely rayed towards girdle edge, rays about thirty in number.

Median valves: Central areas coarsely quincuncially granulose, granules round and flat-topped, a little finer on jugum and a little coarser towards girdle edge; lateral areas elevated, irregularly pustulose, tuberculose towards edge, tubercles longitudinally confluent.

Posterior valve with the mucro ante-median, ante-mucronal areas quincuncially punctate, post-mucronal area coarsely pustulose towards the edge, the pustules concentrically arranged.

Girdle scales very small and regular evenly grooved ovals.

Interior white. Slitting a little weak, 9-1-11.

Dimensions: 8 x 4.5. Maximum: 13 x 7.

Station: At median tide under stones.

Habitat: North Tasmania, King Island, Victoria.

Remarks: In some specimens the radial sculpture on the end valves and lateral areas of the median valves shows more regular raying and little erosion, but the majority are much eroded medially before reaching the senile stage.

ISCHNOCHITON LUTICOLENS.

Plate xxxiv., figs. 7a, b, c, d.

Ischnochiton luticolens Hull, Aust. Zool., iii., 1923, 159, pl. xxiv., f. 10-13. Port Curtis, Queensland. Type in Australian Museum.

Shell small, elongated oval, not carinated. Colour buff or pale brown, sometimes stained with blackish-brown.

Anterior valve densely covered with minute granules, not arranged in any definite pattern.

Median valves with moderately raised, rounded lateral areas, covered with elongated oval granules diverging outwardly; central areas with granules diverging inwardly, rather larger and more clearly defined than those on the lateral areas.

Posterior valve with granules as on the anterior valve, but tending to radiate, central areas similar to the median valves; mucro in front of the middle; the posterior portion concave.

Girdle densely clothed with minute striated scales.

Interior white. Slits 15-1-13.

Dimensions: 11 x 6 mm.

Station: On the under side of small stones embedded in mud, below low water mark.

Habitat: Port Curtis (Barney Point), Queensland.

The following three species are recorded, but are at present indeterminate:—

ISCHNOCHITON ALBINUS.

Ischnochiton albinus Thiele, Die Fauna Sudwest. Austr. iii., 1911, 400, pl. 6, f. 4. Sharks Bay, West Australia.

A minute shell from Surf Point, Outer Bar, Sharks Bay, West Australia,

only 3.5 mm. long and 2 mm. broad, entirely white, the shell arched, scarcely keeled, the mucro post-median. Pustulose throughout, finely reticulate on the jugum. Fourteen slits in the anterior valve, the slits in the posterior valve irregular "but may be the normal eight." Girdle scales small, about 70 μ broad, with numerous grooves (i.e., finely striated). The radula is peculiar.

We are unable to do anything with this minute species, which appears to be the immature of a new species, but the only illustration offered is of a girdle scale. The peculiar radula is well described, but the description is of little assistance until more material is available.

ISCHNOCHITON INDIFFERENS.

Ischnochiton indifferens Thiele, Fauna Sud-west Austr., iii., 1911, 401. Sharks Bay, Western Australia.

Thiele's short description of a shell 4 mm. long by 2.5 mm. broad probably from Sharks Bay, West Australia, makes his species indeterminate until a series has been secured, the characters given being those of an immature shell, the coloration white, marbled with red; elongate oval, semi-keeled, mucro median, sculpture simply granulose; slitting 11-1-8, the sutural laminae small and rounded; the girdle scales small, about 70 μ long and with 16-18 fine grooves.

ISCHNOCHITON AURATUS.

Ischnochiton auratus Ashby, Trans. Roy. Soc. S. Aust., xliv., 1920, 277, pl. xii., f. 6a and b.

The description of two immature specimens leaves this species unrecognisable, and we have been compelled to regard it as based on the very young stage of *Heterozona cariosa* (Pilsbry), as we find this species varies considerably in development, sometimes growing to a considerable size before the typical scale arrangement appears, in others the peculiar character of the girdle being shown in the very young stage. We have been unable to examine the type.

EXPLANATION OF PLATES.

Plate xxxiii.

Fig. 1. Whole shell of *Ischnochiton elongatus* Blainville.
1a. Scales of *Ischnochiton elongatus* (*ustulatus*). } Not to same
1b. Scales of *Ischnochiton elongatus crispus* Reeve. } magnification.
2. Whole shell of *Ischnochiton variegatus* Adams and Angas.
3. Whole shell of *Ischnochiton examinandus laetior* Hull.
3a, b, c, d. Valves and scales of *Ischnochiton examinandus examinandus* Hull.
3e, f, g, h. Valves and scales of *Ischnochiton examinandus laetior* Hull.
4. Whole shell of *Ischnochiton pilsbryi* Bednall.
4a. Side view of *Ischnochiton pilsbryi* Bednall.
5. Whole shell of *Ischnochiton contractus* Reeve.

Plate xxxiv.

Fig. 1. Whole shell of *Ischnochiton versicolor milligani* Ire. and May.
1a. Sculpture of *Ischnochiton versicolor milligani* Ire. and May.
1b. Sculpture of *Ischnochiton versicolor versicolor* Sowerby.
2. Whole shell of *Ischnochiton lineolatus* Blainville.
2a. Sculpture of *Ischnochiton lineolatus* Blainville.
3. Whole shell of *Ischnochiton atkinsoni* Ire. and May.
3a. Sculpture of *Ischnochiton atkinsoni* Ire. and May.
3b. Scales of *Ischnochiton atkinsoni* Ire. and May.
4. Whole shell of *Ischnochiton tateanus* Bednall.
5. Whole shell of *Ischnochiton ptychius* Pilsbry.
6. Whole shell of *Ischnochiton falcatus* Hull.
6a, b, c, d. Valves and scales of *Ischnochiton falcatus* Hull.
7a, b, c, d. Valves and scales of *Ischnochiton luticolens* Hull.